

First record of spotted wing drosophila *Drosophila suzukii* (Diptera: Drosophilidae) in Montenegro

Sanja Radonjić¹* and Snježana Hrnčić¹

¹University of Montenegro, Biotechnical Faculty, Mihaila Lalića 1,
81000 Podgorica, Montenegro
(*sanja_radonjic@t-com.me)

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SUMMARY

The spotted wing drosophila *Drosophila suzukii* Matsumura (Diptera: Drosophilidae) is an invasive pest originating from Southeast Asia. It was detected for the first time in Europe in 2008 (Spain and Italy) and subsequently in other European countries. It is a highly polyphagous pest that infests healthy, ripening fruit and presents a serious threat to fruit production, particularly of soft skinned fruit.

In the first half of October 2013, a new fruit fly species was unexpectedly detected in Tephri traps baited with the three-component female-biased attractant BioLure that is regularly used for monitoring the Mediterranean fruit fly *Ceratitis capitata* Wiedem. (Diptera: Tephritidae) in Montenegro. Brief visual inspection identified the new species as the spotted wing drosophila *D. suzukii*. The pest was first recorded in several localities on the Montenegrin seacoast around Boka Kotor Bay. After the finding, all *Drosophila* specimens were collected from traps for further laboratory observation. A quick follow-up monitoring of other Tephri traps was carried out within the next few days on the rest of the seacoast (localities from Tivat to Ulcinj). Additionally, Tephri traps were set up around Lake Skadar and in the city of Podgorica, as well as on fresh fruit markets in Podgorica.

The results of this preliminary study showed that *D. suzukii* was present in all surveyed locations and adults were captured until late December. Both sexes were found in traps with BioLure.

Our data show that *D. suzukii* is present in southern parts of Montenegro and there is a serious threat of its further spreading, particularly towards northern parts of the country where the main raspberry and blueberry production is placed. The results also show that Tephri traps baited with BioLure can be used for detection and monitoring of spotted wing drosophila.

Keywords: *Drosophila suzukii*; Invasive species; Montenegro

INTRODUCTION

The spotted wing drosophila *Drosophila suzukii* Matsumura (Diptera: Drosophilidae) originates in Southeast Asia, and it was originally described on cherries in Japan in 1916 (Harris et al., 2014). In 2008, it was first reported in North America (California) and Europe (Spain and Italy) (Walsh et al., 2011; Cini et al., 2012). After detection it spread rapidly across European countries (Cini et al., 2012). The latest report on new findings in Europe has come from Serbia (Toševski et al., 2014).

The European Plant Protection Organization (EPPO) has included *D. suzukii* on its A2 list as a quarantine pest. It is a highly polyphagous species that infests both cultivated and wild hosts, especially of the genera *Vaccinium*, *Rubus*, *Prunus*, *Fragaria*, *Vitis*, *Ficus*, *Actinidia*, *Rhamnus*, *Lonicera* and *Sambucus* (EPPO, 2013). Unlike most other Drosophilidae, a female of *D. suzukii* has a serrated ovipositor and is able to lay eggs under the skin of healthy ripening fruits. Larvae develop in fruit flesh, feed there and cause primary damage, so that infested fruits become soft, rotten and unmarketable. Several larvae may infest a single fruit. Males of spotted wing drosophila can be easily detected based on a single black spot on the outer edge of each wing and two dark patches (sex combs) on each of the fore feet. A female has a long, sclerotized, serrated ovipositor, clear wings without spots and no combs on feet.

In the first half of October 2013 the presence of *D. suzukii* was recorded in several locations on the Montenegrin seacoast in Tephri traps baited with the three-component synthetic dry food attractant BioLure (ammonium acetate, trimethylamine hydrochloride and putrescine). A quick follow-up monitoring of the whole seacoast (where the main citrus, fig, pomegranate, persimmon production is placed), as well as the area around Lake Skadar and the city of Podgorica (the main grapevine, peach, nectarine, strawberry and cherry production region), confirmed the presence of the pest. Our preliminary results also showed that Tephri traps containing BioLure, which was originally developed as an attractant for *C. capitata*, can also be used for detection and monitoring of the spotted wing drosophila.

This paper provides the first report on the occurrence of *D. suzukii* in Montenegro.

MATERIAL AND METHODS

The presence of a new fruit fly species was detected at several locations on the Montenegrin seacoast around Boka Kotor Bay (Kumbor, Đenovići and Baošići) on 15 October 2013 using Tephri traps® (Sorygar SL, Las

Rozas, Madrid, Spain) baited with BioLure® Unipak™ (AgriSense-BCS Ltd., Pontypridd, South Wales, UK) plus the insecticide dichlorvos (DDVP strips) (AgriSense-BCS Ltd., Pontypridd, South Wales, UK) (Figure 1). Traps were set at 1.5-2 m height above ground on the southeastern side of fruit tree canopy (mandarin, fig and persimmon). A brief visual observation of captured flies (noting a single black spot on the outer edge of each wing) led us to an assumption that the new species was spotted wing drosophila *D. suzukii* (Figure 2). A quick follow-up monitoring of other Tephri traps was carried out within the next few days along the remaining part of the seacoast (locations from Tivat to Ulcinj), and around Lake Skadar (Godinje) and the city of Podgorica (locations Tološi and Beri). Traps with BioLure were also set up on four fresh fruit markets in Podgorica. In all inspected localities, the traps were checked until the end of December. All *Drosophila* specimens were collected and transferred to 75% ethanol for further laboratory observation. Morphological identification of the species was done using a stereomicroscope ZEISS Stemi 2000-C following the EPPO (2013) diagnostic protocol for *D. suzukii*. Trap captures were expressed as a total number of flies, and number of males and females.

RESULTS

After our first detection of *D. suzukii* in Tephri traps in locations around Boka Kotor Bay (Kumbor, Baošići and Đenovići) and further check of the rest of the seacoast (from Tivat to Ulcinj), the presence of this pest was confirmed in all inspected locations.



Figure 1. Tephri trap baited with BioLure on a mandarin tree



Figure 2. *D. suzukii* (male) captured in a Tephri trap

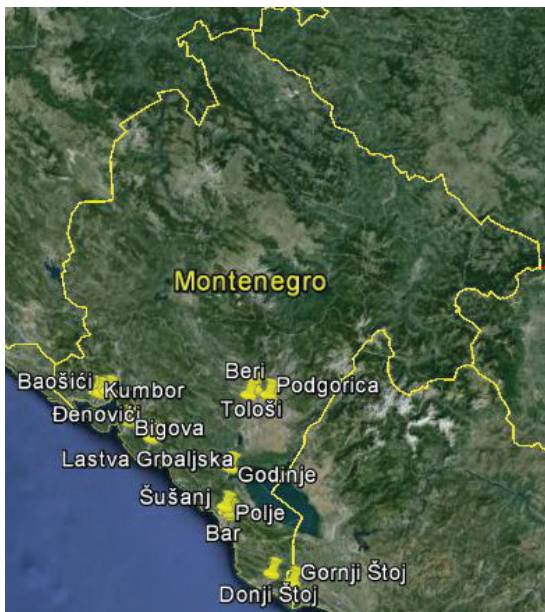


Figure 3. Distribution of *D. suzukii* in Montenegro (October-December 2013)

It was also found in Tephri traps set up subsequently around Lake Skadar (Godinje) and the city of Podgorica (Tološi and Beri), including four fresh fruit markets in the city (Figure 3).

Adults of *D. suzukii* are small flies (2-3 mm) with red eyes and a pale brown to yellowish-brown thorax and abdomen. Males have a single black spot on the outer edge of each wing (Figure 4) and two dark patches (sex combs) on each fore foot with 3-6 “teeth” (Figure 5).



Figure 4. *D. suzukii* (male): single black spot on the edge of each wing



Figure 5. *D. suzukii* (male): sex combs on a fore foot

This morphological feature enables easy visual identification of males. Females are identified by their serrated (saw-like) ovipositor and “teeth” that are much darker than the rest of ovipositor (Figure 6). It is used to pierce the skin of a healthy, ripening fruit in order to lay eggs under its skin. Female wings are clear without spots and there are no combs on their feet, and a stereomicroscope was therefore needed to identify them.



Figure 6. *D. suzukii* (female): serrated ovipositor

The data of our trap inspection showed that the flight activity of *D. suzukii* continued until late December. Captures of both sexes in traps baited with BioLure were also confirmed. Trap captures are presented in Table 1.

Data in Table 1 show that a total of 1672 *D. suzukii* adults (281 ♀♀ and 1391 ♂♂) were collected during the survey. Males outnumbered females in all locations other than Šušanj (area around Bar). *D. suzukii* flies were most abundant in the location Polje (Bar) with 726 captured adults (98 ♀♀ and 628 ♂♂). On the other hand, the lowest number of flies was recorded in locations around the city of Podgorica with 27 captured adults (2 ♀♀ and 25 ♂♂).

Apart from *D. suzukii*, other *Drosophila* sp. were also found in traps containing BioLure during this survey.

Table 1. *D. suzukii* adults collected using Tephri traps baited with BioLure (October-December 2013)

Location	Total number	Females	Males
Kumbor	7	2	5
Đenovići	104	14	90
Baošići	362	52	310
Bigova	106	30	76
Lastva Grbaljska	75	8	67
Šušanj	6	3	3
Bar	22	14	8
Polje	726	98	628
Donji Štoj	89	14	75
Gornji Štoj	93	26	67
Godinje	55	18	37
Beri	17	1	16
Tološi	1	–	1
Fresh fruit market 1	–	–	–
Fresh fruit market 2	8	–	8
Fresh fruit market 3	1	1	–
Fresh fruit market 4	–	–	–

DISCUSSION

Detection of *D. suzukii* in southern parts of Montenegro may pose a serious threat to future grapevine, peach, nectarine, strawberry, cherry and fig production because that is the country’s main production region for those fruits, as well as for some others (citrus, actinidia, persimmon). Based on the fly’s spreading features and its confirmed presence in southern parts of Montenegro, there is a serious threat of its further dispersion, particularly to northern parts of the country where the main raspberry and blueberry production is placed. *D. suzukii* prefers high humidity and moderate temperatures, and it is most active at 20°C (EPP0, 2010; Walsh et al., 2011). It is able to develop on a wide range of both cultivated and wild soft-skinned fruits and many host plants both in native and invaded areas with berries as their preferred hosts (Cini et al., 2012).

Adults are very mobile and have a considerable capacity for natural spread, while long distance trade of infested fruits and plants enables pest dissemination (EPPO, 2010). High dispersal potential of *D. suzukii* and its rapid spread in invaded countries was shown by Cini et. al (2012).

According to several sources (Bolda et al., 2010; Walsh et al. 2011), preliminary studies in the USA (California, Oregon and Washington) had indicated an annual loss of more than \$500 million dollars caused by *D. suzukii* in five affected crops (strawberries, blueberries, raspberries, blackberries and cherries) with a yield loss of 20% for all crops. De Ros et al. (2013) indicated a total damage worth more than 3.3 million EUR annually in the same crops in Italy (Trentino).

It is not possible to trace back precisely the paths and time of introduction of *D. suzukii* in Montenegro because plastic cups filled with apple cider vinegar (trap volume 350-750 ml, 5-6 drilled holes at one side of each cup, holes 5 mm in diameter) were used in our initial surveys from mid-September to the end of December 2012 and from July to September 2013, and no specimens were found in those traps.

Regarding the attraction potential of BioLure, our findings correspond with those of Leblanc et al. (2010), who found that BioLure captured significantly more Drosophilidae, Neriidae and calyptrate flies (Calliphoridae, Muscidae and Sarcophagidae) than either of the other protein lures used.

The results of our preliminary study indicate that the synthetic three-component dry food attractant BioLure can be used for detection and monitoring of *D. suzukii*.

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Prvi nalaz *Drosophila suzukii* (Diptera: Drosophilidae) u Crnoj Gori

REZIME

Drosophila suzukii (Diptera: Drosophilidae) je invazivna vrsta porijeklom iz jugoistočne Azije. U Evropi je prvi put nađena 2008. godine (Španija i Italija), a nakon toga i u ostalim evropskim zemljama. Ova veoma polifagna štetočina napada zdrave plodove u fazi zrenja i zbog toga predstavlja veliku opasnost za voćarsku proizvodnju, a naročito za proizvodnju sitnog voća.

U prvoj polovini oktobra 2013. godine utvrđeno je prisustvo odraslih jedinki nove vrste u Tephri klopama sa trikomponentnim atraktantom BioLure koji se standardno koristi za monitoring mediteranske voćne muve *Ceratitis capitata* Wiedem. (Diptera: Tephritidae) u Crnoj Gori. Vizuelni pregled klopki ukazivao je da se radi o novoj vrsti, *D. suzukii*. Vrsta je prvo zabilježena u lokalitetima u bokokotorskom zalivu (Baošići, Đenovići i Kumbor). Nakon ovog nalaza sve jedinke *Drosophila* sp. su sakupljene radi daljeg laboratorijskog ispitivanja. U narednih nekoliko dana izvršeni su pregledi Tephri klopki i na ostalom dijelu crnogorskog primorja (lokaliteti od Tivta do Ulcinja). Pored toga, Tephri klopke su postavljene u okolini Skadarskog jezera i na području Podgorice, uključujući i zelene pijace.

Rezultati ovog preliminarnog istraživanja su pokazali prisustvo *D. suzukii* u svim posmatranim lokalitetima i hvatanje odraslih jedinki do kraja decembra. U klopama sa BioLure nađene su jedinke oba pola.

Utvrđeno prisustvo *D. suzukii* u južnom dijelu Crne Gore predstavlja veliku opasnost od njenog daljeg širenja, posebno prema sjeveru zemlje koje je glavno proizvodno područje maline i borovnice. Dobijeni rezultati, takođe, pokazuju da se Tephri klopke sa atraktantom BioLure mogu koristiti za utvrđivanje prisustva i monitoring ove vrste.

Ključne reči: *Drosophila suzukii*; invazivna vrsta; Crna Gora.